

SURVEY OF PRACTICE IN ELECTRODERMAL MEASUREMENT

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ABSTRACT

This paper is a report on the results of a survey on electrodermal recording procedures. A detailed questionnaire was sent to more than two hundred members of the Psychophysiological Society. The results indicate a wide disagreement among investigators in most phases of the recording process. This indicates a lack of standardization in one of the most used of physiological measures.

DESCRIPTOR: GSR Survey.

A detailed questionnaire asking for specific information on electrodermal recording procedures was sent to members of the Psychophysiological Society living in the United States and Canada. Under the assumption that members of the Society comprised a large and representative sample of investigators who use these recording procedures, it was hoped that a sufficient number of returns would be made to provide an overview of the present state of the procedures. The questionnaire was also designed to obtain information sufficiently detailed to allow empirical replication and intercomparisons of the procedures described.

Of the 230 questionnaires sent out, 41 replies were received (an 18% return). Many of these replies, however, indicated that electrodermal recording procedures were not being used. Eliminating these, plus a few incomplete returns, left a total of 26 usable questionnaires. Although this sample is small, it does provide some interesting information on current recording practices.

Information was requested on both exosomatic and endosomatic recording. Only three returns indicated that endosomatic recording was being used. This is particularly interesting in view of the fact that many of the returns described recording apparatus that would be quite adequate for endosomatic recording. Even though available, it was not being used. The present report is limited, therefore, to exosomatic procedures only.

Many of the replies expressed serious concern over the adequacy of present recording procedures. In some cases this concern was so great that electrodermal recording was abandoned as a reliable method of obtaining psychophysiological data. For example, one investigator wrote, "I decided that if a technique takes this much fuss and feathers there must be something wrong with the approach. I have therefore turned to other ways of measuring objectively psychic phenom-

This work was supported by Grant MH04172 (05) of the United States Public Health Service and by the Society for the Investigation of Human Ecology.

ena." And from another, "... we have discontinued all recording because of the conclusions from our previous study." Finally, a third wrote, "... many investigators are not confident of the techniques they are using at present. This lack of confidence has plagued us since we started to record GSR a year ago. ... With this background of confusion and ambiguity, we have abandoned this study."

When experimenters avoid and abandon the use of a procedure for lack of faith in it, the problem of its evaluation and standardization can be regarded as more than academic.

The general impression one gets from the present sample is that there is some agreement in recording procedures even at present. A good deal of this agreement, however, is due to the use of a commercially available instrument, the Fels Dermohmeter (10 of the 26 are using this instrument). However, even among those who do so, there is considerable variation in such variables as electrode placement and pretreatment of skin.

The 26 respondents reported 10 significantly different combinations of electrode placements. Favorite placements were: across the palm (seven); from finger to finger (five); and from palm to dorsal or ventral aspects of the arm (five). Other combinations included bilateral palm to palm and various combinations of palmar or finger placements with wrist or arm placements. Plantar placements were used in only two instances. All these placements were being used to record GSR activity.

An even greater heterogeneity was reported on pretreatment of the skin areas from which the recordings were to be made. The most popular agents for skin treatment were alcohol or acetone for reducing the oil content of the skin. Plain water, various soaps, Phisohex, ether, and sandpapering were also used, either alone or in combination with these. In all, 15 different procedures were reported. Only five reports indicated that no pretreatment was used.

Considerably more agreement appeared in the types of electrodes used. The most common choice was some type of Zn-ZnSO₄ electrode. This choice was not limited to those using the Dermohmeter, since 10 others also used this electrode. Some version of the Ag-AgCl electrode was next in popularity. More than one type was used by some experimenters. In the minority were a few such interesting reports as "... a sterling silver teaspoon with the handle sawed off. . . placed in the palm without paste," and an electrode "... the size of a dime, made of silver alloy, with irregular surfaces and a serrated edge."

The Zn-ZnSO₄ and Ag-AgCl electrodes have, of course, been specifically designed to minimize electrode polarizability. However, only four replies indicated that electrode polarization was routinely measured, while 14 specifically stated that it was not measured.

The type of contact medium used again showed wide diversity. Commercially available pastes were used in four cases. Cotton or sponge soaked in a salt solution was used in three cases, and home made pastes were used in the remainder.

The extent of the area of contact between contact medium and skin was in most cases controlled only by the dimensions and configuration of the electrode used. Eight reports, however, indicated that the area was exactly delimited by

applying an adhesive cornpad or adhesive tape with a hole punched out to the skin before applying the electrode.

Twelve reports indicated direct control of room temperature. In two cases the problem of variability of ambient temperature was met indirectly. In the first, subject groups were matched for this variable; in the second, it was taken into account in the statistical treatment of the data by an analysis of covariance. Ambient humidity, on the other hand, was controlled in only four instances.

The information given so far has been concerned only with contact variables. It is apparent that there is considerable variability in recording procedures even before the signal reaches the recording apparatus.

In addition to the 10 respondents who used the Fels Dermohmeter, a commercially available instrument, the Bio-Physical model 201 GSR Amplifier, was used by three others. The remainder used various bridge circuits or potentiometer circuits devised in their own laboratories or modeled after circuits described in the literature. These were constant-current devices in most cases, with currents ranging from 20 to 40 μ a with input impedances from 200 K to 1 meg ohm. Although impedance measures were not specifically included in the questionnaire (because it was felt that very few investigators would use this measure), one such device was reported, with an AC current of 35 to 79 μ amps. A few investigators reported the occasional use of constant voltage devices. One wrote, for example, "Also use a constant voltage system with an exciting voltage chosen according to the current being drawn, i.e., to limit current density to 8 microamp/cm² and high enough so as not to allow endosomatic masking."

Read-out from the recording apparatus was with ink-writing pens in 23 instances, although heat-sensitive paper was used in some cases. A mirror galvanometer was used in one case. Magnetic tape recording was employed by five investigators in conjunction with their other recording procedures.

In addition to information on recording procedures, several questions were included in the questionnaire to obtain information on the terminology preferred for electrodermal measurements. The answers to these questions indicated almost complete lack of agreement. Terms and abbreviations were requested for ongoing basal level, changes in level in response to stimulation, and apparently spontaneous changes in level. Over a dozen terms were suggested for each of these measures, and several respondents objected strongly to making such distinctions at all.

CONCLUSIONS

It appears from this brief summary that there is considerable variety in exosomatic electrodermal recording procedures. Much of this variety is found at points in the recording system prior to the recording apparatus itself. It is possible that some of this variability is merely superstitious behavior not really relevant to functionally important aspects of the recording situation. An example may be the pretreatment of the skin. This possibility, of course, is open to empirical check.

What conformity of practice is found in this sample stems from two sources: (1) the use of commercially available recording systems; and (2) the adoption of

recording procedures that have been standardized in the laboratories of prominent investigators who are actively working in this area.

The adoption of the procedures of a particular laboratory is undoubtedly more widespread than this limited sample shows. An example of this is that the reports describing endosomatic recording procedures were in complete agreement, for the very good reason that they had all adopted the same procedure at the recommendation of the laboratory that developed it. At least a dozen other instances of the adoption of this procedure are known to us. This must also be the case for several exosomatic recording procedures.

The unexpectedly low percentage of questionnaires returned raises some questions about what proportion of those who employ electrodermal recording procedures actually are sufficiently concerned with the properties of the instrument they use to feel strongly that standardization of these procedures is necessary or desirable.

Finally, there was a marked reluctance to answer the questions which asked for the specification of ideal recording systems, perhaps indicating that the opinion in general is that such specifications need yet to be worked out.

There was general agreement on one ideal requirement of recording systems, however. This is typified by the following answer which we quote in its entirety, "Low Cost!"

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